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UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

INFORMATION CIRCULAR

TRIPOLI

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BY

ROBERT W. METCALF

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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

TRIPOLI[1]

By Robert W. Metcalf[2]

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INTRODUCTION

Tripoli is used to designate a number of more or less similar types of silica of sedimentary origin. Usually they are spoken of as "soft" silicas, and are light, very fine grained, porous, and friable. Structure is micro- or crypto-crystalline. The deposits are the residual product of weathering and occur in massive form, either blocky or in friable masses. Tripoli is the end product of the weathering of siliceous limestones, cherty limestones, or cherts. Weathering removes the calcium carbonate, leaving a finely divided siliceous residue to which the name "tripoli" has been applied. Authorities differ as to whether the chert accumulates first and then is converted into tripoli or whether tripoli is derived by direct decay from various forms of silica during initial weathering of the limestone.

Considerable confusion has existed as to what constitutes "tripoli". Due to the similarity of names, tripolite, a type of diatomaceous earth found originally in Tripoli in Northern Africa, has been erroneously called tripoli. Tripoli, however, contains no diatoms, the distinguishing characteristic of diatomaceous earth. The material mined in the Missouri-Oklahoma area has been considered by the trade to be the type material, and many feel that the term "tripoli" should more properly be restricted to the product of this region. Although also designated as soft silica, it would be less misleading, perhaps, if the siliceous material mined in southern Illinois were

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called amorphous silica. Both the Missouri-Oklahoma and Illinois materials are very high in silica. Different in composition, as it is very much lower in silica content than tripoli or amorphous silica, yet included under the classification of tripoli in Bureau of Mines statistical data, is the small but important output of rottenstone in Lycoming County, Pa. The principal justification for grouping these three types of silica is similarity of use.

PHYSICAL AND CHEMICAL PROPERTIES

The tripoli of Missouri-Oklahoma is practically pure silica, as it contains 96 to 99 percent SiO_2, the remainder being chiefly ignition loss and small quantities of alumina, iron, lime, soda, and potash. Chemical composition, however, is much less important in actual use than physical characteristics.

For the Seneca product, the water absorption of crude material averages about 38 percent and that of powdered tripoli about 52 percent, and the porosity of crude is about 45 percent. Fusion point for cream-colored tripoli is cone 33 and for rose tripoli cone 31. True specific gravity varies widely, between 2.15 and 2.63. The apparent specific gravity fluctuates even more, from 1.19 to 0.69 according to fineness of the product. Some variation also occurs in its unit weight under different conditions. Thus, a short ton of tripoli in place occupies about 30 cubic feet; broken or in drying sheds, 45 cubic feet; and powdered and packed for shipment, about 33 cubic feet. Fracture is uneven to conchoidal. Tripoli from this district is a lightweight, very porous material. Blocks from even the more compact beds can be crushed easily in the hand. The individual grains, however, have a hardness sufficient to scratch steel.

The rottenstone mined in Pennsylvania is somewhat heavier in unit weight and lower in silica content than other products included in this report. Composition approximates 60 percent silica, 17 percent alumina, 8 percent alkalies, and 9 percent iron oxide, plus small amounts of moisture, lime, and magnesia. The material apparently is a ferruginous and siliceous shale, having properties rendering it suitable as an abrasive or filler.

Analyses of commercially marketed tripoli and soft silica follow. The chemical composition as indicated may be considered typical, although material of varying characteristics may be produced from each of the districts shown. (The data are taken from Heinz' study of the tripoli industry appearing in the American Institute of Mining and Metallurgical Engineers volume, Industrial Minerals and Rocks.)

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Chemical composition of tripoli and soft silica[1/]

Constituent	Composition, percent					
	Ill.	Ark.	West Tenn. Valley	East Tenn., Georgia	Mo. - Okla. "Cream"	Mo. - Okla. "Rose"
SiO_2.....	99.44	99.72	98.92	93-98	97.70	98.00
Al_2O_3.....	.22	.067	.46	1.0-1.4	.838	.19
Fe_2O_3.....	.14	.003	.07	.22-1.6	.282	.73
CaO.....		.090	.37	Tr.- .30	.001	Tr.
MgO.....		.001		Tr.- .20	.014	Tr.
Na_2O-K_2O...					.148	.29
TiO_2.....				Tr.- .20	.059	
MnO.....					.002	
H_2O (clay).					.099	
Ignition...	.25	.120		.3- .7	.501	.50

1/ The chemical analyses of the Missouri-Oklahoma tripoli are by C. V. Millar, chemist, Joplin, Mo., the other figures from producers in the various districts.

OCCURRENCE

Deposits of tripoli in the United States occur principally in the South and Southwest. The larger reserves are in Missouri, Oklahoma, and southern Illinois. It is found also in more or less extensive deposits in Alabama, Arkansas, Georgia, Mississippi, and Tennessee. Rottenstone has been mined only in Pennsylvania. Brief descriptions of deposits in various states appear below.

Alabama. - Tripoli is found in Lauderdale County in northwestern Alabama and also somewhat farther southwest along the east side of Bear Creek nearly to Margerum, in Colbert County, as a part of a belt extending from Wayne County, Tenn., through Alabama into northeastern Mississippi. In the Bear Creek area a good grade of white tripoli occurs near Riverton and Tredegar. Screen analysis of this material indicates that 53.30 percent will pass a 200-mesh screen and 50.70 percent will pass a 300-mesh screen. A proposed method of preparation includes drying and grinding in a tube mill lined with silex and using flint pebbles to such a fineness that 90 percent will pass a 200-mesh screen, the grading to be accomplished in an air separator. These deposits have not been mined for many years.

Arkansas. - Tripoli was mined and processed near Hot Springs, Garland County, although for many years production has been entirely from the northeastern corner of the State, at Rogers, Benton County. In the latter region, the tripoli apparently is derived from decomposition of the cherty or siliceous limestone beds in the upper part of the Boone formation of Mississippian age. This formation spreads over a considerable part of northern and northwestern Arkansas. A number of deposits other than that mined at Rogers occur in Washington and Madison Counties, adjoining Benton County, and in Baxter County. In the west-central portion of the State appear tripoli beds that have been altered from the Arkansas novaculite formation. Counties in which the tripoli-bearing strata occur include Garland, Hot Spring, Montgomery, Pike,

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and Polk, with small-scale operations confined practically to locations near Hot Springs, Garland County, and Butterfield, Hot Spring County.

Georgia. - The occurrence of tripoli in Georgia is confined to the northwestern part of the State, in Bartow, Catoosa, Chattooga, Floyd, Gilmer, Murray, Polk, Walker, and Whitfield Counties. The first discovery of this material in the United States was reported in 1857 near Dalton, in Whitfield County. No production has been reported for many years, but output was obtained chiefly from Chattooga, Walker, and Whitfield Counties.

The Georgia tripoli deposits lie largely in the upper part of the Knox dolomite of Cambro-Ordovician age and are associated with chert beds. Tripoli also occurs in Georgia associated with the Bangor limestone of Mississipian age, the Shady limestone of Cambrian age, and the Murphy marble of pre-Cambrian age. The tripoli in this State varies in color from the white material found in Catoosa and Chattooga Counties to the cream and buff varieties in Walker and Whitfield Counties. Georgia tripoli is of the amorphous silica type.

Illinois. - Illinois amorphous silica deposits are located within an area of Devonian strata in the southern part of the State in western Union and northern Alexander Counties.

These strata trend north and south through the hilly and rough terrain characteristic of this unglaciated region and cover an oxbow-shaped area approximately 30 miles long and 5 miles wide, spreading to about 10 miles in width in northern Alexander County. The Devonian here consists of interbedded limestones, generally green or brown shales or slates and cherts. The so-called Clear Creek cherts contain the amorphous (soft) silica deposits, as well as hard cherts or novaculites, which have been quarried by open-pit methods and used extensively throughout this area for road building. The amorphous silica, however, occurs in thin beds and is recovered by underground mining.

All the workable deposits are nearly horizontal, seldom dipping more than 5°. The strata largely are unconsolidated and look not unlike layers of hardened or congealed flour. The beds are greatly altered or decomposed and comprize alternate pure-white veins up to about 6 feet in thickness, and darker red or bluish gray material.

Mississippi. - Tripoli in Mississippi occurs as a part of the Iuka formation of the Lower (Iowa) series in the Mississippian system. This formation forms the surface terrain over a large part of northeastern Tishomingo County and is the southwestward extension of the tripoli deposits in Alabama and Tennessee. Exposures are few, and the tripoli is not abundant except in the vicinity of an old silica mine southwest of Eastport. The topography is broken and rugged because of the limestone weathering in this area. When mined, the tripoli was taken down a small valley by tram and thence by Bear Creek to a plant in Alabama on the Riverton Branch of the Southern Railway, where it was ground and prepared for market. The tripoli of Mississippi is of the "soft" silica variety and is generally pure white.

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Missouri - Oklahoma. - The tripoli deposits in this region lie along or near the border of Missouri and Oklahoma and are structurally similar in each State. They are a part of the Boone formation of Mississippian geological age, which consists of a group of alternating beds of limestone and chert with an average over-all thickness of 200 to 350 feet. The principal beds occur in the hilly, weathered limestone country in Ottawa County near Gate, Okla., and Seneca, Mo., in the northeastern corner of Oklahoma and in adjacent Newton County, Mo., and are spread over an area of less than 100 square miles. The deposits are horizontal and are found near the tops of broad flat-topped ridges. The tripoli beds vary from 4 to 15 feet in thickness and as a rule are not excessively folded or faulted. The easily removed overburden generally comprizes 4 to 8 feet of loose soil, gravel, and decomposed tripoli and does not exceed 12 feet in commercially workable areas. East and south of Seneca the cover, and frequently the tripoli also, becomes thicker. With depth the tripoli becomes harder and less marketable.

Tennessee. - The deposits of tripoli in Tennessee extend northeast to southwest diagonally through Wayne County, into Lauderdale County, Ala., and continue on both sides of Bear Creek into Colbert County, Ala., and Tishomingo County, Miss. Tripoli also occurs in southeastern Hardin County, Tenn.

Tripoli is found all along this comparatively narrow belt, but the largest deposits are in three general localities: in the region between Waynesboro and Collinwood, in Wayne County, Tenn.; near Stout, in Wayne and Hardin Counties, Tenn., and in Lauderdale County, Ala.; and along Bear Creek in Alabama and Mississippi.

The tripoli occurs in the southwestern part of the Highland Rim geologic province of Tennessee, a generally flat plateau dissected by the Tennessee River and its tributaries largely into a series of narrow, flat-topped ridges between steep-sided valleys. The tripoli outcrops along the sides and in the bottoms of the stream valleys in this rugged topography. At many places the exposures are easily spotted, as the tripoli is heavily compacted and tends to form vertical banks that can be recognized even though covered with vegetation and detrital matter.

The tripoli in this region is pure white, except for occasional brown streaks caused by iron oxide. It is very soft and crumbles easily in the fingers. The dry powder, crushed easily in the hand, will readily pass a 100-mesh screen, and small quantities will pass 200-mesh openings. When dry the material is very light.

The mineral occurs mainly at the top of the Fort Payne cherty limestone and at the base of the Warsaw limestone. The grains of the tripoli from the Fort Payne formation are comparatively large, and considerable cherty fragments are intermixed with the true tripoli. Grains from the Warsaw beds, on the other hand, although very irregular, naturally are finely and evenly sized. Most of the deposits showing material of commercial grade apparently were located in the Warsaw beds.

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Typical of the deposits in Tennessee are those of Hog Hollow, in the Waynesboro-Collinwood district, and Second Creek in the Stout area. The former is 4 miles south of Waynesboro at the head of Hog Creek. The outcrop measures more than 300 feet, has an average thickness of 30 feet, and is entirely within the Warsaw formation. Reserves in this district are the largest in this series of deposits. Quality seems satisfactory, and highway and rail facilities are ample.

In the Second Creek area the maximum thickness of the tripoli is about 60 feet, and the length of the outcrop along a road cut is about three-tenths of a mile. The product is soft, easily crushed, and pure white. Average analysis indicates a silica content of about 96 percent, iron oxide 1 percent, and other, including alumina, 4 percent. Another road cut a half mile away on the west side of Second Creek exposes tripoli at the same elevation, and it is similar in quality and extent. Again the deposits seem definitely to be derived from the Warsaw limestone.

Deposits in the Knox formation in Bradley County, at Black Fox, near Cleveland, also have been worked in the past. Large deposits in the Knox formation occur near Greeneville, Greene County. Tripoli or, as locally known, "rottenstone", formerly was mined near Butler, Johnson County, in the northeastern corner of the State. Tripoli is known to occur in several counties in west-central Tennessee, including Dickson, Humphreys, Lewis, and Perry.

Analyses of tripoli in Tennessee have been reported as follows:

Locality No.	1	2	3
		Percent	
Silica (SiO_2)....	87.84	98.92	88.60
Alumina (Al_2O_3)..	8.84	.46	6.40
Iron Oxide (FeO).	.66	.07	.22
Lime (CaO).....	-	.37	.57
Magnesia (MgO)...	-	-	2.02
Ignition loss....	2.43	-	2.06

1. Black Fox mine, Cleveland, Bradley County (Bureau of Mines, Bull. 266.)

2. Central Silica Corp. (out of business), Collinwood, Wayne County; analysis by Tennessee Division of Geology.

3. Parsons mine, Decatur County; analysis by Tennessee Division of Geology.

Pennsylvania. - Rottenstone is mined in the United States only in Pennsylvania, near Antes Fort and Muncy, Lycoming County. It occurs as the weathered insoluble silicous residue of the black calcareous Trenton limestone or shale.

MINING

The mining of tripoli is comparatively simple and may be either by shaft or open-pit operation. Drilling, by hand or machine, follows no particular pattern and depends on prior experience in each area. Slow dynamite or black

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powder generally is employed in blasting to reduce the proportion of fines, and the larger boulders, where found, are broken by wedges and hammer or by sledges. The rock in certain areas is hand-loaded into tram cars and conveyed to the mill in various ways.

Arkansas. - Mining in Arkansas is by shaft. The mine portals generally are some distance from the outcrop, and tunnels must be driven through considerable unproductive strata. The tunnels are timbered, and the rooms opening out into workable areas have dome-shaped roofs for better support and safety. The rock is loaded into metal "cans" or skips, which are hoisted to the surface, and the crude material is dumped into hoppers from which point it is trucked to the mill.

Georgia. - Many of the tripoli or amorphous silica deposits in Georgia are overlain by only 2 to 6 feet of overburden and have been mined by open-pit workings. The crude material was shot down either by single or multiple benches, sorted for color, and dried. Some mines in Walker and Whitfield Counties, however, were worked by underground methods. The latter have long since been abandoned and now are practically inaccessible. The product largely was shipped as untreated or unprocessed silica.

Illinois. - Present mining is on a modified room-and-pillar system, sometimes called a "checkerboard" or square-work pattern. The mine portals almost invariably are on steep hillsides, and the workings often extend hundreds of feet back into the hills. A series of parallel rooms 10 feet wide and 7 feet high is opened up, leaving 20-foot pillars to support the roof. To avoid timbering, the roof of each room is carefully arched, which affords additional protection from falling strata. After drilling, the crude material is shot down with black powder, the product ranging in size from 12 inches to flour. The freshly mined silica may contain up to about 25 percent combined and absorbed moisture. It has a cold, clammy feel, yet is only slightly moist to the touch. The darker beds, red or bluish gray in color, which alternate with the usable white layers, have no commerical value. Because of streaks or veins which occasionally appear irregularly in the commercially marketable white seams, mining in many otherwise profitable areas has had to be discontinued.

Missouri-Oklahoma. - Mining in the Missouri-Oklahoma area is entirely an open-pit quarrying operation, with a minimum of explosive used in order to reduce shattering and pulverizing of the product. Formerly large amounts of even-textured tripoli were quarried, using no explosive. This material was carefully sorted and set aside for use in making filter stone. Some filter stones still are made, although most of the tripoli now mined is designated as "crush" and sorted at the mine according to the three predominant colors occurring in the region - white, cream, and rose. In blasting, vertical holes spaced irregularly from 3 to 10 feet or more in depth are shot with black powder or slow dynamite. Wide variations in color of the tripoli in place require greater care in shooting to keep colors as segregated as possible. A large part, and in some recent years, all, of the tripoli mined in Oklahoma is ground and processed for sale at a mill in Seneca, Mo. The crude tripoli as mined is quite wet and is taken to large drying sheds, where usually it

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remains 3 or 4 months, and then is conveyed to the mill for grinding and preparation. One former producer crushed the rock to about 1 inch and put it through a mechanical drier, in place of drying his material in open-air sheds.

Tennessee. - About 4 miles south of Waynesboro, Wayne County, a fine-grained, pure-white tripoli containing over 98 percent silica was drift-mined intermittently for many years. The raw material, which contained very little chert, was trucked 6 miles to Collinwood to a small, efficient plant and placed in storage sheds until milled. Tripoli was formerly mined and milled in Decatur County near Parsons, where beds were said to be 100 feet thick, and in Bradley County, at Black Fox, near Cleveland.

Pennsylvania. - The rottenstone occurring in Pennsylvania has been mined from open pits at Antes Fort and Muncy, Lycoming County. The material is crushed and dried before grinding.

PREPARATION

The preparation of the soft silicas and tripoli involves grain-size reduction. The crude material, however, first is sorted for color and texture and air-dried before shipment to mill. The air-drying usually requires several weeks. Trade demands for certain qualities in the finished product complicate the milling routine, as grinding methods must be flexible enough to conform to individual requirements, such as abundance of superfines, uniform grain size, limits for presence of larger size grain, or special grain-size distribution to give a certain oil-absorption number. A number of mills, now inactive, followed flow-sheets and milling procedures similar to those described below.

Arkansas. - The Arkansas material is ground by wet classification at a mill at Rogers, Benton County. Special products may be produced by further processing the normal finely ground end product of milling. The tube mill employed in grinding is charged with the larger pieces of the badly fractured, decomposed chert. This "like" grinding medium is said to give satisfactory results. Sizes are segregated by means of a series of settling cones, and the products thickened and dried. The iron or other stains occurring along the fractures in the rock largely are removed by close regulation of the final water waste from the settling cones. Three chief products are made, designated as: Admix 025; white, 325-400; and float 600. All pass 325-mesh sieves, and each grade comprizes 60 percent by weight of grains smaller than 10 microns.

No crushing was necessary at a mill formerly processing tripoli near Hot Springs, due to the natural fineness of the product in situ. The material was trucked to the plant, where, after drying, it was conveyed directly to the first of two air separators, from which a 325-mesh product was recovered. From the other separator, mounted below, a 200-mesh grade was obtained in the ratio of about part of 200-mesh material to 3 parts of 300-mesh. The finished products were sold to paint manufacturers and to makers of cleaning compounds.

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Illinois. - The white silica occurring in southern Illinois may be ground, either wet or dry. In the wet-grinding process, one mill crushes the raw rock to about ½ inch, after which it is ground in tube mills using flint pebbles. In closed circuit with the tube mill are bowl classifiers. Two products for use in pigments are produced - fine-grained and superfine-grained. Another wet-griding plant in southern Illinois produces several grades of silica ranging from 65 to 99.9 percent through 325-mesh. Alternatively, dry grinding equipment with air classification may be employed.

Kansas. - Although deposits of tripoli of commercial importance in Kansas are not known, there formerly was a mill at Baxter Springs in Cherokee County in the extreme southeastern corner of the State, which treated material mined just over the line in Oklahoma. This mill, designed to process 50 tons per 8-hour shift, has been idle for several years and has been dismantled.

Missouri-Oklahoma. - The tripoli as it comes from the mine is hand sorted for texture and color and separated into white, cream, and rose shades. This sorted material is then stacked or piled in open sheds to air-dry for approximately 3 to 6 months. The mills now operating in this area use dry preparation methods. The crude tripoli from the sheds undergoes coarse crushing either in hammer mills or in coal breakers followed by smooth rolls. The product that passes a ½-inch screen is then dried and pulverized, after which it passes to vibrating screens in closed circuit with the grinding mills. The darker colored tripoli presents less difficulties in processing than the lighter tinted material, as the latter, under certain conditions, becomes charged with static electricity, and requires special precautions in screening technique.

As above stated, tripoli is prepared in three colors - white, cream, and rose - and in the following grain sizes and designations:

Air-float - all through 200-mesh and 98 percent through 325-mesh.

Parting - 98 to 99 percent through 200-mesh.

Admix - 90 percent through 200-mesh and 30 percent smaller than 10 microns.

Buffing - 100 percent through 40-mesh and 80 to 85 percent through 200-mesh.

Extra fine admix - 70 percent smaller than 10 microns.

Another, perhaps more prevalent, break-down of the mill products is as follows: Once ground, or minus 65-mesh, 87 percent through 200-mesh; "double ground", or 110-mesh, 96 percent through 200-mesh; air float, or all through 250-mesh and special air float, or all through 300-mesh or finer. These classifications apply to white, rose, and cream material.

Selected tripoli for filters is sawed into rough shapes and dried in sheds or by artificial heat. Disks, tubes, and cylinders are made on lathes or ground to exact dimensions on carborundum-surfaced wheels.

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Tennessee. - At an operation at Collinwood, Wayne County, now inactive, the crude tripoli was conveyed from the storage sheds to a rotary drying kiln, where the raw material was dried to about 9 percent moisture. A pebble mill in closed circuit with an air separator disintegrated the rock. The milled product was screened to remove unweathered chert fragments before passing to the air separator. The latter prepared four commercial grades of tripoli flour.

Tripoli was processed in the early twenties at Black Fox near Cleveland, Bradley County. Here the crude rock was dried, passed through a ¼-inch trommel, and conveyed to a Hardinge mill to break up lumps and then to an air separator. From the air separator, four grades of tripoli of each color were produced, although a much wider range of sizes was possible. The usual sizes marketed were: 100 percent through 200-mesh, 1 percent retained on 325-mesh; 100 percent through 200-mesh, 3 percent retained on 325-mesh; 100 percent through 200-mesh, 8 percent retained on 325-mesh; and 100 percent through 140-mesh, 15 percent retained on 325-mesh.

Another mill was operated some years ago near Parsons, Decatur County, in the Fort Payne, Mississippian formation. The tripoli here was a white, fine-grained, soft, coherent material occurring in deposits said to be 100 feet thick. The processing equipment included a rotary drying kiln, revolving screens, tube mill, air separator, and accessory conveyors. The finished product could be classified as fine as 99.75 percent through 300-mesh. The mill had a rated capacity of 1½ tons of ground tripoli per hour.

Pennsylvania. - The rottenstone produced in Pennsylvania, after preliminary crushing and drying in a rotary drier, is ground and air-floated in Raymond air-separation equipment. The finely divided material is then conveyed to storage bins, bagged on automatic bagging machines and shipped. Two chief products are prepared - a minus 250-mesh grade is consumed as a filler, largely in phonograph records, and a somewhat coarser grade for polishing purposes.

PRODUCTION

Tripoli was first discovered about 1870 in southwestern Missouri and was partly developed in 1872. No production was made, however until 1887, when new machinery was installed for fine grinding as well as for sawing, turning, and shaping block tripoli into the form of disks, cylinders, or tubes for water filters. Production was on a limited scale until 1892. During that year, the American Tripoli Co., of Carthage, Mo., was organized, and in 1905 took over the plant of the Seneca Filter Works, which had built a mill at Seneca some 9 or 10 years before. The history of the tripoli industry in Missouri and later also in Oklahoma follows to a large extent the expansion and growth of the American Tripoli Co. and its present day successor, Barnsdall Tripoli Co.

Separate statistics on tripoli output are not available before 1913, as diatomaceous earth and tripoli formerly were considered by many authorities to be the same or similar materials and were grouped in Geological Survey records of mineral production. Aside from scattered small outputs in

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the eighteen-nineties in Georgia, Virginia, and possibly Alabama, mining and preparation of tripoli up to 1914 were confined to Missouri. Beginning in 1907 and continuing to the present, silica or "amorphous silica" produced in southern Illinois also has been included with the tripoli figures. Illinois is the only State for which a practically complete record of output since 1913 can be published, and these figures appear in the appended table. Production of so-called "rottenstone" was first reported in Pennsylvania in 1913, and a small output has been marketed each year thereafter. Initial mining of tripoli in Oklahoma came in 1914, of amorphous silica in Tennessee in 1924 (except for a small output in 1913) and of tripoli in Arkansas in 1929. For 1933 to 1941, inclusive, some production came from California, and in 1939 to 1941, amorphous silica was marketed from Texas. Georgia produced sporadically before 1936. The bulk of the output since 1907, however, has come from Illinois, Missouri, and Oklahoma.

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Production of Tripoli in the United States 1913-44

Year	Total Tripoli		Illinois Only	
	Short tons	Value	Short tons	Value
1913	1/20,797	1/$216,581	12,994	$128,892
1914	1/17,218	1/142,428	10,387	59,394
1915	30,711	2/128,957	23,756	2/59,390
1916	43,257	2/215,216	33,187	2/82,968
1917	26,069	338,188	16,133	207,738
1918	19,982	199,854	12,004	100,126
1919	24,292	181,541	13,014	116,492
1920	40,233	569,677	24,458	360,651
1921	12,340	213,013	7,765	125,352
1922	30,205	316,728	18,747	194,371
1923	27,082	382,757	11,522	117,201
1924	28,476	389,409	13,466	116,188
1925	29,388	434,886	11,809	143,859
1926	31,369	523,609	11,948	192,483
1927	26,099	447,068	3/	3/
1928	34,043	555,576	3/	3/
1929	38,011	545,658	12,889	139,557
1930	32,439	507,505	9,954	116,307
1931	26,682	310,131	12,651	87,481
1932	14,775	232,700	6,097	84,795
1933	20,878	350,383	8,757	149,979
1934	20,529	329,356	7,417	119,418
1935	27,375	383,416	10,001	113,484
1936	28,487	391,878	10,981	138,063
1937	34,936	450,570	11,647	151,154
1938	22,188	329,081	8,141	117,107
1939	33,474	466,380	11,134	148,310
1940	30,212	366,569	11,521	155,576
1941	29,301	421,746	13,833	200,700
1942	17,536	272,428	12,575	203,390
1943	14,912	244,365	10,203	168,758
1944	18,425	301,863	12,031	205,732

1/ Includes output in Missouri as follows: 1913, 7,529 short tons, $83,995 and 1914, 6,721 tons, $81,434. Bureau of Mines not at liberty to publish totals for this State in later years.
2/ Estimated at average value of crude material sold.
3/ Bureau of Mines not at liberty to publish figures.

SPECIFICATIONS

No recognized specifications or generally followed testing procedures exist with respect to any of the amorphous silica or tripoli products. Virtually all tests are based on previous experience and generally are entirely academic in character and scope. Some consumers use rough color "Standards", based on matching samples in water or actual paint samples, or by previously established arbitrary criteria. Others specify a certain grit tolerance, to which, however, similar grades of apparently the same composition may react very differently. Loose dry-bulk weight may be determined by the Scott paint volumeter, or settling tests made to establish distribution of subsieve sizes, a factor to which increasing attention is being given.

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USES

Distribution of tripoli by uses was first presented in 1933, and is shown in an accompanying table for the period since that year. The proportion of the output consumed for various uses also is given. A considerable portion of the total tonnage reported in each year, however, was sold to dealers or jobbers, so that often the producers have no definite knowledge of the details of the end uses for which their product is consumed. In any event, it is believed that this table shows a reasonably accurate break-down of the principal uses of tripoli.

The chief markets for tripoli, as indicated by the data shown, are as abrasives, especially buffing and polishing compositions, and as inert and chemically stable fillers in a wide range of products. Sizable amounts are consumed in concrete admix and foundry facings. Minor quantities in various years have been reported used as an ingredient in oil-well drilling fluids, in pottery and as filter blocks.

Buffing Compounds. - One of the more important outlets of tripoli is its use in buffing compounds. In fact, the meaning of the term "tripoli composition" has been widened from the original designation as specifically a compound containing tripoli as the abrasive agent to include almost any abrasive material used for such a purpose. In recent years, however, the tripoli compound has consumed about 30 percent of the total tripoli production, and is used to cut down and to impart high luster to such metals as copper, brass, aluminum and zinc. It is furnished in many grades from a dry, hard, "cut-and-color" composition to the straight greasy type of product for faster-cutting action. The grades and applications of the burring and buffing compounds are varied by using different varieties of abrasives, such as emery, rouge, ground flint, ground sandstone, or fused alumina.

Tripoli (and diatomaceous earth) is used as an ingredient in polishing cloths or rags made of wool or other fabrics which have been saturated with fatty oil, mineral oil, paraffin or a combination of these substances in which very finely pulverized material is suspended. Such impregnated cloths are effective for many metals. Abrasive particles also have been suspended in other mediums, such as soap solutions, pine oil, and ammonia.

Concrete Admix. - Tripoli has extensive employment as an admix for cement and concrete products, such as cement stucco, mortar, plaster, finishing, topping, floors, pavements, and curbs. The material must be finely ground and is shipped in 100-pound paper-lined jute bags. The tripoli does not shrink or swell when wet. Its porosity allows quick absorption of water, and through interaction with water and cement it coats all aggregate particles, thus having a lubricating effect. The workability and flowing properties of the mix are thereby greatly increased. The tripoli also prevents segregation during long truck hauls. Greater early and ultimate strength, decreased efflorescence, high impermeability to moisture after setting, and increased resistance to weather, sulfates, acids, oil, industrial wastes, and other corrosive substances are among other advantages claimed. It also promotes a dense structure without honeycombing and allows thorough and even curing. This material has the additional advantage of neutralizing any excess of free lime and of checking any tendency of the concrete to disintegrate,

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Sales of tripoli by uses, 1933-44

Year	Abrasives				Concrete admixture			
	Short tons	Value	Percent of total		Short tons	Value	Percent of total	
			Quantity	Value			Quantity	Value
1933 1/	7,034	$109,185	47.7	43.9	866	$13,703	5.9	5.5
1934 1/	8,516	135,678	52.4	53.9	582	9,973	3.6	4.0
1935	10,162	159,134	37.1	41.5	3,040	42,450	11.1	11.1
1936	16,943	247,948	59.5	63.3	2,074	27,834	7.3	7.1
1937	15,235	228,373	43.6	50.7	2,126	21,627	6.1	4.8
1938	8,097	138,807	36.5	42.2	2,170	12,634	9.8	3.8
1939	10,953	169,370	32.7	36.3	1,653	24,580	4.9	5.3
1940	10,279	119,609	34.0	32.6	1,683	15,895	5.6	4.3
1941	13,407	198,252	45.7	47.0	1,179	15,168	4.0	3.6
1942	5,447	85,013	31.0	31.2	754	8,895	4.3	3.3
1943	6,146	101,248	41.2	41.4	335	4,690	2.3	1.9
1944	13,218	210,592	71.7	69.8	316	4,552	1.7	1.5

Year	Filler				Oil well drilling			
	Short tons	Value	Percent of total		Short tons	Value	Percent of total	
			Quantity	Value			Quantity	Value
1933 1/	1,907	$ 41,163	12.9	16.6	(2/)	(2/)	-	-
1934 1/	2,224	34,872	13.7	13.8	(2/)	(2/)	-	-
1935	4,810	65,445	17.6	17.1	-	-	-	-
1936	3,107	38,454	10.9	9.8	-	-	-	-
1937	8,363	108,285	23.9	24.0	(2/)	(2/)	-	-
1938	5,584	78,900	25.2	24.0	-	-	-	-
1939	9,016	120,284	26.9	25.8	(2/)	(2/)	-	-
1940	8,451	113,862	28.0	31.1	1,840	$16,949	6.1	4.6
1941	10,020	145,063	34.2	34.4	1,925	22,835	6.6	5.4
1942	8,887	144,055	50.7	52.9	(2/)	(2/)	-	-
1943	6,894	114,929	46.2	47.1	-	-	-	-
1944	3,423	66,147	18.6	21.9	(2/)	(2/)	-	-

Year	Foundry facing				Other uses 3/				Total	
	Short tons	Value	Percent of total		Short tons	Value	Percent of total		Short tons	Value
			Quantity	Value			Quantity	Value		
1933 1/	2,426	$37,750	16.4	15.2	2,515	$46,718	17.1	18.8	14,748	$248,519
1934 1/	2,477	38,231	15.2	15.2	2,459	33,024	15.1	13.1	16,258	251,778
1935	2,590	40,254	9.4	10.5	6,773	76,133	24.8	19.8	27,375	383,416
1936	(2/)	(2/)	-	-	6,363	77,642	22.3	19.8	28,487	391,878
1937	(2/)	(2/)	-	-	9,212	92,285	26.4	20.5	34,936	450,570
1938	(2/)	(2/)	-	-	6,337	98,740	28.5	30.0	22,188	329,081
1939	(2/)	(2/)	-	-	11,852	152,146	35.5	32.6	33,474	466,380
1940	(2/)	(2/)	-	-	7,959	100,254	26.3	27.4	30,212	366,569
1941	(2/)	(2/)	-	-	2,770	40,428	9.5	9.6	29,301	421,746
1942	(2/)	(2/)	-	-	2,448	34,465	14.0	12.6	17,536	272,428
1943	(2/)	(2/)	-	-	1,537	23,498	10.3	9.6	14,912	244,365
1944	(2/)	(2/)	-	-	1,468	20,572	8.0	6.8	18,425	301,863

1/ Includes in 1933, 71 percent of total tonnage of tripoli sold; in 1934, 79 percent.
2/ Included under "Other uses."
3/ Includes small tonnages used for filter blocks and in pottery.

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Dry Cleaning and Laundering. - Tripoli acts as an absorbent for fats, greases, and stains in dry cleaning. The most delicate silks and laces, it is asserted, are not injured and a freshening of color and pattern results. Added to laundering baths, tripoli similarly is said to be effective as an absorbent for greases, oils, and other foreign matter.

Other Uses. - Many foundries use tripoli as a facing or dusting material for molds. Because of its porosity and affinity for soaking up moisture, tripoli used as a foundry facing or parting is "waterproofed". Stearic acid or tallow are the principal coating agents and are used either alone or in various combinations. Other components of these mixtures may be tristearin, paraffin, oleates, and small amounts of waxes and similar materials. These substances are dissolved in solvents such as various petroleum derivatives and mixed with the tripoli under high temperatures or added directly to the melted fatty coating materials. In either case, long-continued agitation is necessary to coat any large proportion of the individual particles.

Metal polishes and polishes for lacquer and similar surfaces often contain tripoli as the mild abrasive. Phonograph records may contain tripoli as a filler. Also it may be used as a filler in paints, stains, and rubber; as a polishing medium for mirrors and glassware, for stone products such as marble, and as a mild abrasive or smoothing agent on precious stones, horn or shell products, and various metals. Tripoli can be employed as a carrier in tree-dusting sprays and other insecticidal or germicidal preparations. It is used to a limited extent in water filtration, wine clarification, or other filtering, including chemical products. Its "soft," mildly abrasive properties permit its incorporation into soap and scouring powders, and hand soaps or pastes.

MARKETING

The crude silica, when sold unprocessed, largely is marketed direct to grinders or to users. The refined products, however, are sold not only direct to consumers but also to brokers or jobbers and to various trade-supply houses, who, in turn, distribute the processed minerals to local purchasers. Usually packed in paper or paper-lined jute sacks, the weight per unit of sale varies from 50 pounds to more than 200 pounds, exclusive of the container. Filter stones generally are made to order and sold by volume. Over a period of years, close business contact has been established between producer and consumer. Consumers often are very reluctant about changing their source of supply, as the range of specifications submitted for a new product is insufficient for predicting behavior in actual practice. Slight variation in analysis or physical properties of the raw material also may effect decidedly unfavorable and troublesome changes in the consumer's end product.

PRICES

Prices of tripoli, rottenstone, and amorphous silica over a period of years have changed but little and have reflected a comparatively stable price situation. Advances usually have been small, although the upward trend in general has reflected the increasing refinements in preparation accorded

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these products. Quotations for Illinois silica appearing in E & M J Metal and Mineral Markets, December 13, 1945, were as follows: Water-ground and floated, in bags, f.o.b. Illinois shipping point, 325-mesh, $21 to $40 per short ton for 92 to 99⅔ percent grades; dry-ground, airfloated, 325-mesh, 92 to 99½ percent silica, $18 to $30. The same journal reported the following quotations on tripoli, f.o.b. Missouri, in paper-lined burlap bags, minimum carload, 30 tons: rose-and cream-colored, once ground through 40-mesh, $14.50; rose-and cream-colored, double-ground through 110-mesh, $16; and air-floated through 200-mesh, $26.

Quotations on the various types of silica herein discussed as given in the Oil, Paint and Drug Reporter of January 14, 1946, were as follows: Amorphous silica, in bags, carlots, f.o.b. Illinois works, dry-ground 325-mesh, $17 per short ton; 400-mesh, $18; wet-ground minus 325-mesh, $18 per ton; 400-mesh, $18 per ton; 96 to 98 percent silica, 325-mesh, $20 per ton and 99 percent silica, 325-mesh, $20 per ton. Tripoli quotations at works, carlots, in bags, according to the same source were: Air-float, $21.50 per short ton; double-ground, $17.50 per ton and once-ground, $16 per ton. Carlots of rottenstone, packed in bags, were quoted at $25.50 per short ton, f.o.b. mines.

FOREIGN TRADE

Imports. - Imports of tripoli and rottenstone have been combined with diatomaceous earth in official foreign trade statistics. Although the rottenstone and tripoli figures are somewhat obscured by this treatment, there appears below a tabulation of the receipts of these minerals over a period of years. Although it is not possible to verify it definitely, most of the material imported from Algeria-and-Tunisia and Canada probably should be considered as diatomaceous earth or kieselguhr. Judging by the high average values indicated, many of these import shipments apparently have been subjected to intensive preparation.

Exports. - No separate data are available to indicate actual quantities of tripoli, amorphous silica or rottenstone exported. It is understood, however, that only the Missouri - Oklahoma tripoli has been exported in appreciable amounts. Tripoli pulverized and graded into specific sizes suitable for buffing and polishing has been shipped to many countires of the world. The largest tonnage is said to be consumed in the United Kingdom and smaller amounts are shipped to Germany, Netherlands, France, and other European countries. Shipments also have been made to South America, Canada, India, and the Far East. In normal times, it is understood that total exports may aggregate several thousand tons a year.

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Imports of Tripoli, Rottenstone, and Diatomaceous Earth in the United States, 1934-44

Country	1934		1935		1936		1937	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Belgium	-	-	-	-	11	$229	11	$356
Spain	132	$3,036	98	$2,036	25	568	-	-
United Kingdom	6	380	11	685	7	327	1	160
U.S.S.R.(Russia)	-	-	761	5,247	-	-	-	-
Algeria & Tunisia	45	709	40	613	704	2,318	608	6,714
Canada	1,184	33,578	509	16,226	216	7,703	155	4,884
Brazil	-	-	-	-	-	-	1	18
Other Countries	50	150	1	118	3	614	2	75
	1,417	37,853	1,420	24,925	966	11,759	778	12,207

Country	1938		1939		1940		1941	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Belgium	19	$530	2	$ 99	-	-	-	-
United Kingdom	1	183	1	174	1	$49	2	$181
Algeria & Tunisia	195	1,803	138	1,191	20	159	-	-
Canada	121	5,775	21	851	5	358	6	355
Mexico	105	1,325	4	54	172	3,001	353	7,547
Brazil	-	-	4	163	5	200	22	903
Other Countries	4	210	25	237	-	-	2	130
	445	9,826	195	2,769	203	3,767	385	9,116

Country	1942		1943		1944	
	Long tons	Value	Long tons	Value	Long tons	Value
United Kingdom	5	$283	-	-	-	-
Canada	6	383	5	$268	3	$60
Mexico	195	4,160	-	-	-	-
Other Countries	-	-	-	-	-	-
	206	4,826	5	268	3	60

FOREIGN DEPOSITS

Deposits of tripoli and rottenstone in foreign countries are not extensive. The former, however, has been produced on a small scale in France, Spain, and Germany.

A true rottenstone mined in England occurs at Hull, in the Yoredale rocks of Derbyshire, and also in Wales and Belgium. This material, a residual product of the weathering and disintegration of siliceous, argillaceous limestone, carries more impurities and less silica than the Missouri-Oklahoma tripoli. Its chemical composition varies within the following approximate limits:

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Silica, 80 to 85 percent; alumina, 4 to 15 percent; carbon 5 to 10 percent; iron oxides, 5 to 10 percent; plus small amounts of lime. It is a soft, very light, finely divided light to olive gray product. Uses include polishing wood and metal, and as a paste, for rubbing down or smoothing painted and varnished surfaces. In normal times, this rottenstone is exported to the United States and to Europe and provides one of the abrasive bases in certain English paste and liquid metal polishes.

PRODUCERS OF TRIPOLI, AMORPHOUS SILICA, AND ROTTENSTONE

Arkansas

Corona Products Inc., Rogers. Deposit near Rogers, Benton County.

California

Western Talc Co., 1901 E. Slauson Ave., Los Angeles. Deposit near Barstow, San Bernardino County.

Illinois

Olive Branch Minerals Co., 725-28th St., Cairo. Deposit near Olive Branch, Alexander County.
Ozark Minerals Co., 807½ Washington Ave., Cairo. Deposit near Elco, Alexander County.

Missouri-Oklahoma

Barnsdall Tripoli Corp., Seneca, Mo. Deposits near Seneca along and near the Missouri-Oklahoma State Line. Mill in Missouri.

Pennsylvania

Penn Paint & Filler Co., Antes Fort. Deposit in Lycoming County.
Keystone Filler & Mfg. Co., Muncy. Deposit in Lycoming County.

POSSIBLE BUYERS OF TRIPOLI, AMORPHOUS SILICA, AND ROTTENSTONE

California

Braun Corp., 2260 E. 15th St., Los Angeles.
Los Angeles Chemical Co., Santa Fe at 15th St., Los Angeles.

Connecticut

Apothecaries Hall Co., Waterbury.
Fuller Brush Co., Industrial Div., 3586 Main St., Hartford.
Lea Mfg. Co., Maple and Cherry St., Waterbury.
Puritan Mfg. Co., Waterbury.

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Illinois

George S. Mephan Corp., Ayers & Lodge St., E. St. Louis.

Chicago

Allied Industrial Products Co., 19 N. Elizabeth St.
Avondale Chemical Co., Cleveland & Hobbie Sts.
Belke Mfg. Co., 951 N. Cicero Ave.
Chas. F. L'Hommedieu Sons Co., 4525 Ogden Ave.
Mandersheid Co., 601 W. Washington St.
Matchless Metal Polish Co., 842 W. 49th St.
S. Obermayer Co., 2559 W. 18th St.
James H. Rhodes & Co., 153 W. Hubbard St.
Geo. A. Stutz Mfg. Co., 1649 Carroll Ave.
Tamms Silica Co., 22 N. LaSalle St.
Turco Products, Inc., 48th & So. Halstead Sts.

Indiana

International Metal Polish Co., 1910 Quill St.

Massachusetts

Flash Chemical Co., 2d & Rogers Sts., Cambridge.
Harrison & Co., 490 Groveland St., Haverhill.
Lever Bros., Co., Cambridge.
H. A. Stiles & Co., 166-174 Portland St., Boston.
Wadsworth-Howland Co., Inc., 139 Federal St., Boston.

Michigan

J. C. Miller Co., Lake Mich. Drive and N.Y.C.R.R., Grand Rapids.

Detroit

Bruce Products Corp., 5710-12th St.
Formax Mfg. Co., Bellevue at Mack St.
Frederick B. Stevens, Inc., 500-520 3d St.
Wayne Chemical Products Co., 9501 Copeland Ave.
E. J. Woodison Co., 7415 St., St. Aubin Ave.

New Jersey

Hanson-Van Winkle-Munning Co., 100 Church St., Matawan.
R. M. Hollingshead Corp., 844 Cooper St., Camden.
Munning & Munning, Inc., 204 Emmett St., Newark.
J. L. Prescott Co., Passaic.
United Laboratories Co., Linden.

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New York

E. Reed Burns Mfg. Co., 51 Withers St., Brooklyn.
Creco Co., Inc., 36-42 43rd Ave., Long Island City.
S. A. Day Mfg. Co., 1487 Niagara St., Buffalo.
Larkin Products, Inc., 701 Seneca St., Buffalo.

New York City

Chas. B. Crystal Co., Inc., Dodge Bldg.
Stanley Doggett, Inc., 473 Canal St.
K. F. Griffiths & Co., Inc., 280 Madison Ave.
Hammill-Gillespie, Inc., 225 Broadway.
King & Malcolm Co., Inc., 242 Water St.
Minerals & Insulation Corp., 71 Wooster St.
L. A. Salomon & Bro., 216 Pearl St.
J. T. Stanley Co., Inc., 642 W. 30th St.
Whittaker, Clark & Daniels, Inc., 260 Broadway.

Ohio

Dubois Soap Co., 1120 W. Front St., Cincinnati.
Hill & Griffiths Co., 1265-67 State Ave., Cincinnati.
Harshaw Chemical Co., 1933 E. 97th St., Cleveland.
National Sales Corp., 31-35 E. 13th St.
Proctor & Gamble Co., Gwynne Bldg., Cincinnati.

Pennsylvania

Samuel H. French Paint Co., 400-412 Callowhill St., Philadelphia.
Walter C. Gold, 235 Rose St., Philadelphia.
Chas. A. Wagner Co., Inc., 811 Callowhill St., Philadelphia.
Westinghouse Electric & Mfg. Co., 35 Cable Ave., E. Pittsburgh.

Wisconsin

S. C. Johnson & Son, Inc., Carnu St., Racine.

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